In the annual summary of the *India Weather Review* for 1908 the observations included in monthly issues are discussed in detail, and the departures of the monthly and annual means from the normal values are calculated for each element. Dr. Walker states that, on the whole, 1908 was cooler than usual, although in April and June, both of which were dry months, the temperature was in decided excess of the normal. Excluding the hill stations, 1908 was a year of average rainfall; of the four seasons, the cold weather and south-west monsoon were more rainy than usual, while the other two periods were markedly dry. With respect to the monsoon rainfall, the character was opposite to that prevailing in the previous seven years, all of which were in defect. The most striking feature of the year was the heavy rainfall in the dry zone of north-west India, due to the strong monsoon currents in July and August.

The report of the Transvaal Meteorological Department, containing observations and results in the usual form for the year ended June 30, 1908, has been received. The number of rainfall stations has greatly increased, and includes those which formerly reported to the Irrigation Department. The rainfall was below the average generally; at Pretoria the deficiency amounted to 31 per cent., and at Johannesburg to 10 per cent. Farmers suffered from want of water, but, among the compensating factors, remarkable freedom from locusts and little damage from hailstorms are mentioned. In connection with this report we may refer to interesting contributions by Mr. Innes (director) and Mr. Wood (chief assistant) to the climatology of the Transvaal in the current number of the Journal of the Scottish Meteorological Society. Mr. Innes remarks that it is one of the sunniest climates inhabited by civilised races, the average cloudiness being about 30 per cent., and the relative humidity low. Speaking of the High Veld generally, which is at an elevation of about 4000 feet, it is warm by day and cool at night. The rainfall averages 25 to 30 inches, the number of days with rain being only about eighty-five. At places like Johannesburg (5750 feet) the cold during winter is considerable, owing more to the cold wind than to actual temperature. Over the latter (Witwatersrand) district Mr. Wood shows that the mean monthly rainfall increases with great regularity from July (0·11 inch) to January (5·80 inches), and then diminishes to June (0·09 inch). The probability of heavy rainfalls (1 inch and above) is entirely confined to the months October–March inclusive.

The Department of Agriculture, Nairobi, has issued its fifth annual report of meteorological records in British East Africa, containing monthly rainfall values for fifty-six stations during 1908, and averages for ten years (1899–1908) and under at twenty-five stations. The latter show that the mean annual rainfall varied from about 16 inches at Kismayu to 72 inches at Mumias. Meteorological summaries for 1908 are given for ten stations; so far as these show, the absolute extremes of temperature were 99° at Nandi (6000 feet above sea) in February, and 35° at Elmenteita (height not stated) in January.

The Weekly Weather Report issued by the Meteorological Office, London, for the period ending January 1 contains a summary of temperature, rainfall, and bright sunshine for the year 1909. From this it is seen that for the fifty-two weeks ending January 1 the temperature was below the average over the entire kingdom. The rainfall was in excess of the average in all the English districts except in the south-west, but it was generally deficient in Scotland and Ireland. The largest aggregate measurement of rain is 47·12 inches, in the west of Scotland; the least amount for the year is 26·04 inches, in the east of England. The greatest excess of rain is 5·21 inches, in the south-east of England, and the greatest deficiency 6·91 inches, in the north of Scotland, whilst in the north of Ireland the aggregate measurement was 5·53 inches deficient. The rainy days were in excess of the average over the entire country, except in the west of Scotland and in the English Channel. The greatest excess was twenty-two days, in the east of England. The greatest number of rainy days was 250, in the north of Scotland, and the least 186, in the south-east of England. The duration of bright sunshine for the year was in excess of the average over the whole of the British Isles, except in the north-east of England, where there was a deficiency of forty-three hours. The greatest excess was 146 hours, in the south-east of England. The longest duration of bright sunshine was 1975 hours, in the Channel Islands, and this was followed by 1743 hours in the south-east of England. The least duration was 1157 hours, in the north of Scotland, which, however, is forty-eight hours more than the average. The mean temperature at Greenwich for 1909 is 48·9°, which is 1·2° below the average of the past sixty years. The highest monthly mean is 62·7°, in August, the lowest 37·2°, in February. The temperature was below the mean in every month except in January, April, October, and December. The absolutely highest temperature was 86°, in August, the lowest 14°, in March, which gives a range of 72° in the year. The temperature was above the average on 144 days, and frost occurred on sixty-five nights, fifty-two of which occurred in January, February, March, and December. The total rainfall for the year was 25·71 inches, which is 1·58 inches more than the average of the last sixty years. The wettest months were June, July, and March, in each of which the total fall exceeded 3 inches. In all, rain fell on 186 days, December having as many as twenty-three wet days and March twenty-two. There were during the year 1637 hours of bright sunshine at Greenwich, which is 138 hours more than the average. The sunniest month was May, with a record excess of 140 hours. Snow fell on twenty-four days and fog occurred on forty-three days during the year.

EDUCATIONAL TENDENCIES IN THE UNITED STATES.

THE first volume of the report of the U.S. Commissioner of Education for the year ended June 30, 1909, has now been published, and is consequently available at an earlier date after the conclusion of the year with which it deals than any previous report. The second and concluding volume of the report is to be issued early in March next.

The present instalment, which runs to 598 pages, is prefaced by an introduction by the Commissioner, Dr. E. E. Brown, which gives a brief *résumé* of the more important subjects dealt with at length in the succeeding chapters. It is possible here to refer to a few only of the numerous subjects of interest discussed in the volume.

Industrial education has commanded attention in all parts of the States during the past year. The report points out that it has become increasingly evident that one of the vital elements of the problem, so far as the United States are concerned, is the question of the relation of school training to shop practice or apprenticeship. Accounts are given of several experiments which are being tried in various States. The special combination of shop practice with regular scholastic training, which was introduced two or three years ago by the University of Cincinnati, is receiving much attention, and a modification of this plan has been carried into effect in the public schools of Fitchburg, Mass. Model and practice schools have been provided for the teaching of manual arts in connection with the State normal school in Fitchburg. A cooperative course in preparation for the metal trades has been introduced into the Lewis Institute, in Chicago, for boys from sixteen to twenty years of age. Each boy in each of the two years of this course spends twenty-six weeks in the shop and twenty-four weeks in school, receiving from his employer the school tuition fee of 10*l.* a year and 1*l.* a week for the time he works in the shop. The report emphasises the fact that many diverse and often opposing interests are concerned in the effort to work out an American system of industrial education. All these interests are to be given full and fair consideration, and it is being borne in mind that, to render such a system stable and altogether American, it must be made genuinely educational.

Agricultural education has been stimulated during the year by the inquiries and the report of the Commission on Country Life, appointed by President Roosevelt. The establishment of agricultural high schools in different parts of the country goes forward steadily. Mississippi and Arkansas have made important beginnings in the establishment of such schools during the year, and Minnesota has

provided for agricultural departments in the graded schools of the State.

Referring to American colleges and universities, Dr. Brown gives it as his opinion that among the leaders of American university education there is a growing and surprisingly unanimous conviction regarding the directions in which improvement should be made in higher education in the States. It is to be rendered more coherent, vital, and democratic. As President Butler has remarked:—"The American college is under fire, no doubt. Well-directed intelligent firing will do it good. It is far from perfect, but it knows its job, and is working at it with the skill born of long and successful experience." The democratic movement in higher education has been emphasised during the year by the effort to organise in Massachusetts an institution which shall bring courses of college instruction home to all communities in the State in which it may be desired—a project which has been referred by the Legislature to the new State Board of Education for an opinion as to its advisability; by the step taken by Cornell University in the direction of the State university form of organisation, and by the beginnings at the University of Wisconsin of a more comprehensive and widely diffused system of university extension.

Within the year the University of Wisconsin has been a centre of public interest in a variety of ways, not the least important of which is the Vilas bequest, which is expected to amount to 400,000*l.*, and to be administered so that it shall eventually reach a total of 4,000,000*l.* The fact that the available income of this fund is to be devoted largely to research renders it an epoch-making endowment.

In addition to its treatment of the problems of American education, the volume provides an admirable series of summaries of educational progress in European and other countries. Separate chapters are devoted to educational problems in Hawaii, the Philippines, Porto Rico, the Argentine Republic and Chile, Great Britain and Ireland, France and Central Europe. Educational reform in China and current educational topics in foreign countries each receive special treatment.

These educational reports from Washington have often been praised in these columns, and it will suffice to say that the latest report fully maintains the excellence of its predecessors.

OLE RÖMER AND THE THERMOMETER.[1]

THE first thermometers of which the indications were independent of atmospheric pressure appeared in the latter half of the seventeenth century, but Fahrenheit was the first one to succeed, in 1710, in solving the problem of furnishing these thermometers with such scales that their indications agreed; these thermometers were much admired, and represented great progress. It may therefore be of interest to show that Ole Römer solved this problem before Fahrenheit, and that it was from him that Fahrenheit obtained his method.

From some stray remarks which I happened to come across in scientific literature of the eighteenth century, I saw that Ole Römer probably occupied himself with the construction of thermometers, and that some connection existed between him and Fahrenheit. These statements had the effect of inducing me to look for traces of Römer's work in the libraries and archives here in Copenhagen. In the university library I found what I was looking for—a work by Römer called "Adversaria," a volume of written papers in folio bound in a brown cover.[2]

The book contains a whole section about the thermometer, besides some scattered statements about temperature measurements, which I shall return to later. The arrangement of Römer's thermometer seems to me to be of considerable interest. Römer appears to have been the first to construct thermometers with the two fixed points, the temperature of melting snow—"Nix sine gelu et calore"—and the boiling point of water, and with the cubic contents of the tube divided into equal parts. Both Römer and Horrebow's remarks seem to indicate that this took place about the year 1702. The first part of this section is mathematical, and deals chiefly with the problem of dividing the cubic contents of a conical glass tube into equal parts. Römer finds a general method of making such a division, and calculates approximate formulas by the aid of which he may carry out more easily his calculations; he employs these formulas in dividing the cubic contents of a conical tube 8 inches long, intended for his "original thermometer," into four equal parts, and he gives the length of these parts when he determines that the scale of the thermometer is to have sixty divisions, and these are to be arranged in such a way as to read "boiling 60, snow without cold or warmth $7\frac{1}{2}$." After these preliminary investigations Römer gives complete instructions in four paragraphs for "the construction of an original[1] thermometer."

"(1) By means of a drop of mercury investigate whether the cavity of the tube, be it cylindrical or conical, is regular before the ball is blown out. Irregular forms are to be rejected; the cylindrical form may be employed without further investigation. With regard to the conical forms, proceed as follows:—

"(2) From the middle of the tube towards the outer points take the lengths of the drop of mercury.

"(3) When by means of this experiment the divisions have been divided into two equal parts, each of these parts is in turn divided into two equal parts proportionally by increase or diminution, and the whole tube will thus be divided into four equal parts.

"(4) When the thermometer is completed, filled and closed, fix by means of snow or crushed ice the point of division $7\frac{1}{2}$, by means of boiling the point 60."

After these instructions there are remarks written in Horrebow's hand and with his signature which are supplementary, and show also that Römer's thermometer existed after his death (1710):—". . . In 1739, Römer's widow sent me five glasses for thermometers which Römer himself had filled and divided with two points in accordance with his own rules given above. The alcohol in them is rather pale, although Römer coloured it with saffron in the usual manner. . . . After this was written, I asked Römer's widow if she knew whether Römer, after I had left his observatories, had made any change in his thermometer. She said that she did not know, but she gave me Römer's *vade mecum*, in which I found a loose sheet, which is pasted in here after the next sheet. On that I read that Römer fixed upon 8 as the dividing-point for snow, and thus, so far as we know, the alcohol never sinks below 0 in Copenhagen, and it is to be remarked that January 7, 1709, the alcohol only sank to $7\frac{6}{10}$."

The loose sheet which Horrebow mentions contains a table of temperatures which gives the temperature for every day from December 26, 1708, to April 1, 1709.

The two following pages contain a sort of table of corrections for the four divisions.

After this short account of the contents of the eleven folio pages which Römer devoted to the construction of his "new" thermometer, it will be appropriate here to give a short explanation of his method and to point out what is new in it.

The chief feature of the method is this: to base the division of the thermometer on two fixed points, the melting point of thawing snow and the temperature of boiling water, and to find the length of the degree by dividing the cubic contents of the thermometer tube between these two points into equal parts, taking into consideration whether the tube is cylindrical or not. The size of the degree is obtained on the basis of the fact that there must be between the freezing point and the boiling point 52·5 degrees of equal cubic content. If the tube is cylindrical the whole length between the two fixed points is divided into $52\frac{1}{2}$ equal parts, and 7·5 similar parts are added

[1] v. Kirstine Meyer: Temperaturbegrebets Udvikling gennem Tiderne og dets Forhold til vekslende Anskuelser om Varmens Natur. Gjellerups Boghandel. Inaugural Dissertation. (Copenhagen, 1909.)

[2] The language in "Adversaria" is chiefly Latin; the book will be published in 1910 under the auspices of the Kgl. danske Videnskabernes Selskab.

[1] Some weights which are still in existence from Römer's time, and probably are those that he constructed as standards for the new system of weights and measures introduced by the Act of May 1, 1683, bear the inscription "original weight." From this it may be inferred that "original thermometer" means "standard thermometer," and that it was Römer's purpose to introduce a standard for thermometers as for other units of measure.